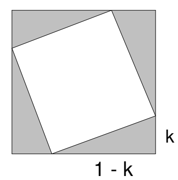
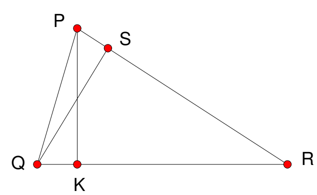
1. Since the area of the larger square is 1 cm^2, each side of the larger square is 1. Therefore, the possibilities for the sides of each of the shaded triangles are k and $1-k$. Therefore, we know that $\frac{1}{2}k(1-k) = \frac{1}{4} \div 4$. Thus $k(1-k) = \frac{1}{8}$. Since k is the value of a side of the triangle, by symmetry the other possible value for k is $1-k$. Thus the product of all possible values is $\boxed{\frac{1}{8}}$

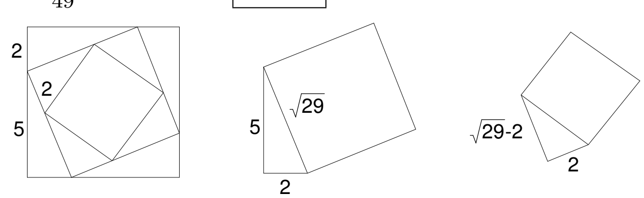


2. $\overline{QS}, \overline{PK}$ are altitudes and $\overline{RP}, \overline{RQ}$ are bases of $\triangle PQR$.
The area of a triangle is $\frac{1}{2} \times base \times height$, giving us the following equation:

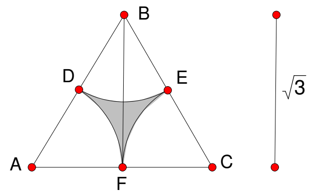
$$\begin{aligned} \frac{1}{2}(6)12 &= \frac{1}{2}(QS)8 \\ 72 &= 8(QS) \\ QS &= \boxed{9} \end{aligned}$$



3. Use Pythagorean Theorem to find the measures of the sides of each of the squares as shown below. Now the area of the largest square is $7^2 = 49$ and the area of the smallest square is $(\sqrt{37-4\sqrt{29}})^2 = 37 - 4\sqrt{29}$. The percent of the area of the largest square in the area of the smallest square is $\frac{37-4\sqrt{29}}{49} \times 100 = \boxed{31.5\%}$



4. The area of the shaded region is the area of the equilateral triangle minus the area of the three 60° sectors of a circle with radius 1. The height of the equilateral triangle is $\sqrt{3}$. The area of the equilateral triangle is $\sqrt{3}$. The area of one of the sectors is $\frac{60}{360}\pi = \frac{\pi}{6}$. The area of three of the sectors is $\frac{3\pi}{6} = \frac{\pi}{2}$. The area of the shaded region is $\boxed{\sqrt{3} - \frac{\pi}{2}}$

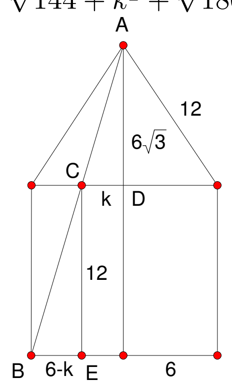


5. $\boxed{20}$

6. The information gives us the picture shown below. We are looking for AB. $\triangle ACD \sim \triangle CBE$.

$$\begin{aligned}
\frac{k}{6-k} &= \frac{12}{6\sqrt{3}} \\
6\sqrt{3}k &= 72 - 12k \\
6\sqrt{3}k + 12k &= 72 \\
k(6\sqrt{3} + 12) &= 72 \\
k &= \frac{72}{6\sqrt{3} + 12}
\end{aligned}$$

Now the length of the diagonal is $\sqrt{144 + k^2} + \sqrt{180 - 12k + k^2}$.



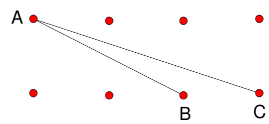
We can use the calculator to find k and, in turn, the length of the diagonal to be $\boxed{23.18}$

7. This problem had no solution.

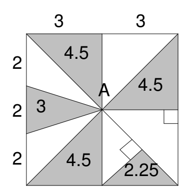
8. Suppose the dots on the grid are spaced x apart.

$$\begin{aligned} x^2 + (2x)^2 &= (3\sqrt{5})^2 \\ x^2 + 4x^2 - 45 &= 0 \\ 5x^2 - 45 &= 0 \\ x^2 - 9 &= 0 \\ x^2 &= 9 \\ x &= \pm 3 \end{aligned}$$

$x = 3$ since we can't have a negative length. $AC = \sqrt{9^2 + 3^2} = \sqrt{81 + 9} = \sqrt{90} = \boxed{3\sqrt{10}}$



9. The problem is a simple. Just fill in the lengths of the segments in the picture to and find the areas of each of the shaded triangles as shown in the picture. $\boxed{\frac{25}{48}}$



10. $\boxed{36}$